Improving Care for Low-Birth-Weight Infants Using Internet-Based Telemedicine

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The admission of a newborn child to the neonatal intensive care unit (NICU) is among the most emotionally distressing situations that a family can face. Young families with little experience with critical care medicine are thrown into a high-tech environment that is bewildering and foreign to most parents[1]. A sick child may pose emotional, educational, and logistical problems for a parent. During a family's stay in the NICU and following discharge, they need not only top-quality medical care but also effective and creative information-sharing. We hypothesized that Internet and telemedicine technologies could influence these family needs and lower health care costs. This paper describes our efforts to design, implement, and test a high-tech approach to provide individualized support to the families of very low-birth-weight (VLBW) infants, which we call Baby CareLink[2].

Baby CareLink was created by a team of neonatologists, nurse practitioners, social workers, child-life specialists, medical informaticians, and software engineers. Baby CareLink is a multifaceted telemedicine program that incorporates videoconferencing and World Wide Web (WWW) technologies to enhance interactions among families, staff members, and community providers. The videoconferencing module allows virtual visits and distance learning from a family's home during a baby's hospitalization as well as virtual house calls and remote monitoring after discharge. The six major areas of clinical content and resources in the Baby CareLink Web are a daily clinical report, a message center, a see-your-baby section, a family room, a clinical information section, and a section on preparing to discharge to home. In addition, its security architecture allows efficient and confidential sharing of patient-based data and communications among authorized hospital and community users.

A randomized trial of Baby CareLink was conducted in a cohort of VLBW infants born between November 1997 and April 1999. Eligible infants were randomized within 10 days of birth. Families of intervention group infants were given access to the Baby CareLink telemedicine application. A multimedia computer with a WWW browser and videoconferencing equipment was installed in their homes within 3 weeks of birth. The control group received care as usually practiced in this NICU. Quality of care was assessed using a standardized family satisfaction survey administered after discharge. In addition, we measured the effects of Baby CareLink on hospital length of stay as well as on family visitation and interactions with the baby and the staff.

Of the 176 VLBW infants admitted during the study period, 30 control and 26 study patients were enrolled. The groups were similar in patient and family characteristics as well as rates of inpatient morbidity. The CareLink group reported higher overall quality of care. Only 3 percent of families in the CareLink group noted one or more problems or issues with care compared with 13 percent of control families ($P<0.05$). CareLink families also reported greater satisfaction with the unit's physical environment and visitation policy (13 percent versus 50 percent reporting problems, $P< 0.05$). The frequency of family visits, telephone calls to the NICU, and holding of the infant did not differ between groups. The duration of hospitalization until ultimate discharge home also was similar in the two groups

(68.5±28.3 versus 70.6±35.6 days, $P \geq 0.05$). Among infants born weighing less than 1,000 grams (N=31), there was a trend toward shorter lengths of stay (77±26.2 versus 93±35.6 days, $P > 0.05$). All infants in the CareLink group were discharged directly to home, whereas 5 of 30 (17 percent) of control infants were transferred to community hospitals prior to ultimate discharge to home ($P < 0.05$).

During the study period, 1,033 CareLink WWW sessions were initiated by NICU and project staff members (1.8 sessions/day). During the same period, the 26 CareLink families initiated 1,744 sessions. This represents 67 sessions per family and an average of 0.98 sessions per inpatient day. The average duration of a WWW session for all users was 5.4 minutes. Most family sessions were initiated from the home. The mother's security token was used to initiate 64 percent of the WWW sessions. The patient-specific areas within the CareLink WWW were the most commonly visited. During the study period, families initiated 328 videoconferencing sessions, with each session lasting an average of 6 minutes.

CareLink significantly improves family satisfaction with inpatient VLBW care and definitively lowers costs associated with hospital-to-hospital transfer. Our data suggest that using telemedicine and the Internet supports the educational and emotional needs of families, thus facilitating earlier discharge of VLBW infants to home. We believe that expansion of the Baby CareLink model to the postdischarge period will significantly improve the coordination and efficiency of care.

The ability to support low-birth-weight infants (less than 1,000 grams) is a marvel of modern medicine but extracts an emotional toll on the family. Our study suggests that our intervention, which was designed to support the emotional and educational needs of families, improved care and supported families, who were encouraged to take their children home sooner. Families without CareLink technology tended to stay longer but felt that their stay was too short. Technologies such as the ones we have evaluated can offer every family better communication with their physicians, better coordination of care with their nurses, and better collaboration with other members of their community. Paradoxically, we have used a high-tech approach in a high-tech environment to provide a more humane "high-touch."

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DISCLOSURE

Dr. Safran is Chief Executive Officer of Clinician Support Technology (CST) and Associate Clinical Professor of Medicine, Harvard Medical School; Ms. Pompilio-Weitzner is Clinical Content Specialist to CST; and Dr. Gray is Director of Newborn Services at Beth Israel Deaconess Medical Center and Assistant Professor of Pediatrics, Harvard Medical School, and holds equity in and serves as a consultant to CST.

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